IS 4545-4 (1983): Methods of measurement on receivers for television broadcast transmissions, Part 4: Synchronizing quality [LITD 7: Audio, Video and Multimedia Systems and Equipment]

BLANK PAGE

IS : 4545 (Part 4) - 1983
(Reaffirmed 2003)

Indian Standard

METHODS OF MEASUREMENT ON RECEIVERS FOR TELEVISION BROADCAST TRANSMISSIONS

PART 4 SYNCHRONIZING QUALITY

(First Revision)

UDC 621·397·62 : 621·397·335

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 4

July 1986

Indian Standard

METHODS OF MEASUREMENT ON RECEIVERS FOR TELEVISION BROADCAST TRANSMISSIONS

PART 4 SYNCHRONIZING QUALITY

(First Revision)

Radio Communications Sectional Committee, LTDC 20

Chairman	*Representing*
Shri H. S. Jolly	All India Radio, New Delhi
Members	
Shri O. P. Khushu (*Alternate* to Shri H. S. Jolly)	
Additional Director Standards (S & T)	Ministry of Railways (RDSO)
Joint Director Standards (S & T) - IV (*Alternate*)	
Cdr S. S. Baidwan	Ministry of Defence (DPI) (N), New Delhi
Lt-Cdr A. Bhomick (*Alternate*)	
Shri A. K. Basak	Development Commissioner, Small Scale Industry, New Delhi
Shri V. V. R. Prabhu (*Alternate*)	
Shri H. M. Bhatnagar	Indian TV Manufacturers Association, New Delhi
Shri V. K. Sethi (*Alternate*)	
Shri H. S. Chandramouli	Bharat Electronics Ltd, Bangalore
Shri K. Ramaseshu (*Alternate*)	
Shri R. G. Deodhar	Wireless Planning and Co-ordination Wing (Ministry of Communications), New Delhi
Shri M. L. Dhar	Directorate General of Civil Aviation, New Delhi
Shri P. K. Dhingra (*Alternate*)	
Shri A. K. Ghose	Indian Telephone Industries Ltd, Bangalore
Shri N. Krishnan Kutty (*Alternate*)	
Shri B.P. Ghose	National Test House, Calcutta
Shri B. C. Mukherjee (*Alternate*)	
Shri J. Gupta	The Radio Electronic & Television Manufacturers Association (RETMA), Bombay
Shri T. S. Buxi (*Alternate*)	
Shri J. Gupta	Peico Electronics & Electricals Ltd, Bombay
Shri P. S. Sachdev (*Alternate*)	
Shri B. S. Gupta	Federation of Associations of Small Industries of India, New Delhi
Dr S. K. Hajela	Institution of Electronics and Telecommunication Engineers, New Delhi
Shri S. Janakiraman	Directorate of Coordination (Police Wireless), Ministry of Home Affairs, New Delhi
Shri R. P. Mathur (*Alternate*)	
Lt-Col Krishan Lal	Ministry of Defence (DGI), New Delhi
Lt-Col B. S. Natrajan (*Alternate*)	

(*Continued on page* 2)

(*Continued from page* 1)

Members	*Representing*
SHRI R. LALWANI	Posts & Telegraphs Board, New Delhi
SHRI V. V. CHAUDHARY (*Alternate*)	
SHRI R. C. PANDEY	Ministry of Defence (DTD & P) (AIR), Bangalore
SHRI C. M. KRISHNA MURTHY (*Alternate*)	
SHRI A. K. N. PRASAD	Hindustan Aeronautics Ltd, Bangalore
SHRI M. G. SRIDHARAN (*Alternate*)	
SHRI W. V. RAMANA	Electronics Corporation of India Ltd, Hyderabad
SHRI K. P. RAMASWAMY	Directorate General of Doordarshan, New Delhi
SHRI K. B. BORKER (*Alternate*)	
SHRI P. K. RANGOLE	Central Electronics Engineering Research Institute, Pilani
SHRI H. K. JAIN (*Alternate*)	
SHRI M. SANKARALINGAM	Directorate General of Supplies and Disposals, New Delhi
SHRI R. S. ARORA (*Alternate*)	
SHRI S. SHARMA	Department of Electronics, New Delhi
DR K. S. K. SAI (*Alternate*)	
SHRI C. G. SUBRAMANYAN	Electronics Trade and Technology Development Corporation Ltd, New Delhi
SHRI ISHWAR DUTT (*Alternate*)	
SHRI SURESH CHANDRA	National Physical Laboratory, New Delhi
SHRI K. K. TANEJA	Directorate General of Technical Development, New Delhi
SHRI H. S. DUBEY (*Alternate*)	
SHRI C. M. THIRUMURTHY	Gujarat Communications and Electronics Ltd, Vadodara
SHRI N. SRINIVASAN, Director (Electronics)	Director General, ISI (*Ex-officio Member*)

Secretary

SHRI D. K. NAYYAR
Assistant Director (Electronics), ISI

Panel for TV Receivers, LTDC 20/P3

Convener	
SHRI N. N. MOHANTY	All India Radio, New Delhi
Members	
SHRI A. S. GUIN (*Alternate* to Shri N. N. Mohanty)	
SHRI M. L. ARORA	M/s Chawla & Company, New Delhi
ASSISTANT WIRELESS ADVISER (PLANNING-I)	Wireless Planning and Coordination Wing (Ministry of Communication), New Delhi
SHRI H. M. BHATNAGAR	Indian TV Manufacturers Association, New Delhi
SHRI R. B. LAL (*Alternate*)	
SHRI R. S. BHATNAGAR	Federation of Associations of Small Industries of India Ltd, New Delhi
SHRI K. B. BORKER	Directorate General of Doordarshan, New Delhi
SHRI M. BUTCHI RAJU	Electronics Corporation of India Ltd, Hyderabad
SHRI P. JANARDHAN (*Alternate*)	
SHRI R. K. CHAKRAVARTI	Department of Electronics, New Delhi
SHRI A. GHAFFAR	U.P. Electronics Corporation Ltd, Lucknow
SHRI S. JANAKIRAM	Information & Public Relations Department, Government of Andhra Pradesh, Hyderabad
SHRI K. L. KANDOI	The Radio Electronic and Television Manufacturers Association, Bombay
SHRI S. MITRA	Electronic Regional Test Laboratory (North), New Delhi
SHRI INDERJEET BANAUDHA (*Alternate* I)	
SHRI C. L. KAUL (*Alternate* II)	
SHRI A. RAZZAQUE	Central Electronics Engineering Research Institute, Pilani
REPRESENTATIVE	Tamil Nadu Local Administration Radio and Television Manufacturers Organization, Madras
SHRI P. K. SANDELL	Electronics Trade and Technology Development Corporation Ltd, New Delhi
SHRI C. G. SUBRAMANYAN (*Alternate* I)	
SHRI C. S. ARORA (*Alternate* II)	
SHRI V. V. R. SASTRY	Bharat Electronics Ltd, Bangalore
SHRI V. K. SEKHRI	Electronic Components Industries Association, New Delhi
SHRI SURESH CHANDRA	National Physical Laboratory, New Delhi
SHRI INDERJEET BANAUDHA (*Alternate*)	

Indian Standard

METHODS OF MEASUREMENT ON RECEIVERS FOR TELEVISION BROADCAST TRANSMISSIONS

PART 4 SYNCHRONIZING QUALITY

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part 4) (First Revision) was adopted by the Indian Standards Institution on 6 December 1983, after the draft finalized by the Radio Communications Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 The first version of IS : 4545 covered the methods of measurement for television broadcast receivers having monochrome vision reception. With the introduction of colour television receivers, this standard is now being revised to make it applicable to receivers designed for both monochrome and colour vision reception, and published in a number of parts to deal with different aspects of characteristics of television receivers.

0.3 This standard (Part 4) covers methods of measurement for synchronizing quality of the television receivers. Other parts in this series are:

Part 1 General considerations

Part 2 Tuning properties and general measurements

Part 3 Geometrical properties of the picture

Part 5 Sensitivity

Part 6 Selectivity and response to undesired signals

Part 7 Fidelity

Part 8 Compatibility with audio visual recording equipment

Part 9 Electrical and acoustic measurements at audiofrequency

0.4 This standard (Part 4) is largely based on IEC Publication 107-1 (1977) Recommended methods of measurement on receivers for television broadcast transmissions: Part 1 General considerations electrical measurements other than those at audio-frequencies, issued by the International Electrotechnical Commission.

0.5 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard (Part 4) covers methods of measurement for synchronizing quality of television receivers, namely:

a) Line scan phase error characteristic,

b) Line scan phase transfer characteristic,

c) Line scan synchronizing range,

d) Pulling on whites,

e) Pulling on vertical synchronizing pulses,

f) Ragging,

g) Weave and ripple,

h) Horizontal scan phasing,

j) Quality of interlace,

k) Jumping,

m) Scan generator frequency variation with time, and

n) Effects of scanning circuits upon colour signal decoding.

1.2 This standard shall be read in conjunction with IS : 4545 (Part 1)-1983*.

2. LINE SCAN PHASE ERROR CHARACTERISTIC

2.1 Introduction — The phase error characteristic of a line scan flywheel circuit indicates the extent to which the receiver line scan circuit will follow phase perturbations present on the line synchronizing pulses and thus indicates the disturbance

*Methods of measurement on receivers for television broadcast transmissions: Part 1 General considerations (*first revision*).

that will occur to vertical picture components in the presence of either random or coherent noise affecting the line synchronizing pulse train and the associated picture signal. Such perturbations may be present in the output signal of some video recording and reproducing equipment.

2.2 Method of Measurement — The measurement procedure is shown in Fig. 1. The line synchronizing pulse generator is phase-modulated by the output of a low-frequency sine-wave oscillator. The phase error is displayed on the oscilloscope, care being taken to ensure that the trigger is taken from the correct point. The level of signal applied to the receiver shall be such that noise and over-loading effects are avoided.

Measurement shall be carried out for a range of perturbating frequencies extending from below field frequency up to half-line scan frequency. A typical characteristic is shown in Fig. 2, indicating that below a given frequency, the receiver line scan generator tracks with the perturbating signal while at some high frequency no tracking occurs due to filtering action of the flywheel automatic phase control circuit. The result is plotted with the frequency of perturbation on a logarithmic horizontal scale and the receiver line scan generator tracking error as a percentage on a linear vertical scale.

2.3 Presentation of Results — The value of $\left|\frac{\phi_0 - \phi_1}{\phi_0}\right|$ percent is plotted as a function of the frequency of perturbation by the low frequency sine-wave oscillator, where ϕ_0 = phase deviation of the input synchronizing signal, and ϕ_1 = phase deviation of the line scan oscillator output (*see* Fig. 2).

3. LINE SCAN PHASE TRANSFER CHARACTERISTIC

3.1 Introduction — The phase characteristic of a line scan flywheel circuit indicates the extent to which the receiver line scan circuit will reject noise present on the synchronizing signals that does not also phase-modulate the associated picture signal. This is the situation when receiving a signal accompanied by background noise.

3.2 Method of Measurement — The measurement procedure is as in **2.2** except that the oscilloscope connections are different (*see* Fig. 3). A typical characteristic is shown in Fig. 4 indicating that the receiver line scan generator response falls with increasing frequency of perturbation. The result is plotted with frequency on a logarithmic horizontal scale and the receiver line scan generator perturbation as a percentage on a linear vertical scale.

3.3 Presentation of Results — The value of $\left|\frac{\phi_1}{\phi_0}\right|$ percent is plotted as a function of the frequency of perturbation by the low frequency sine-wave oscillator where ϕ_0 = phase deviation of the input synchronizing signal. ϕ_1 = phase deviation of the line scan oscillator output (*see* Fig. 4).

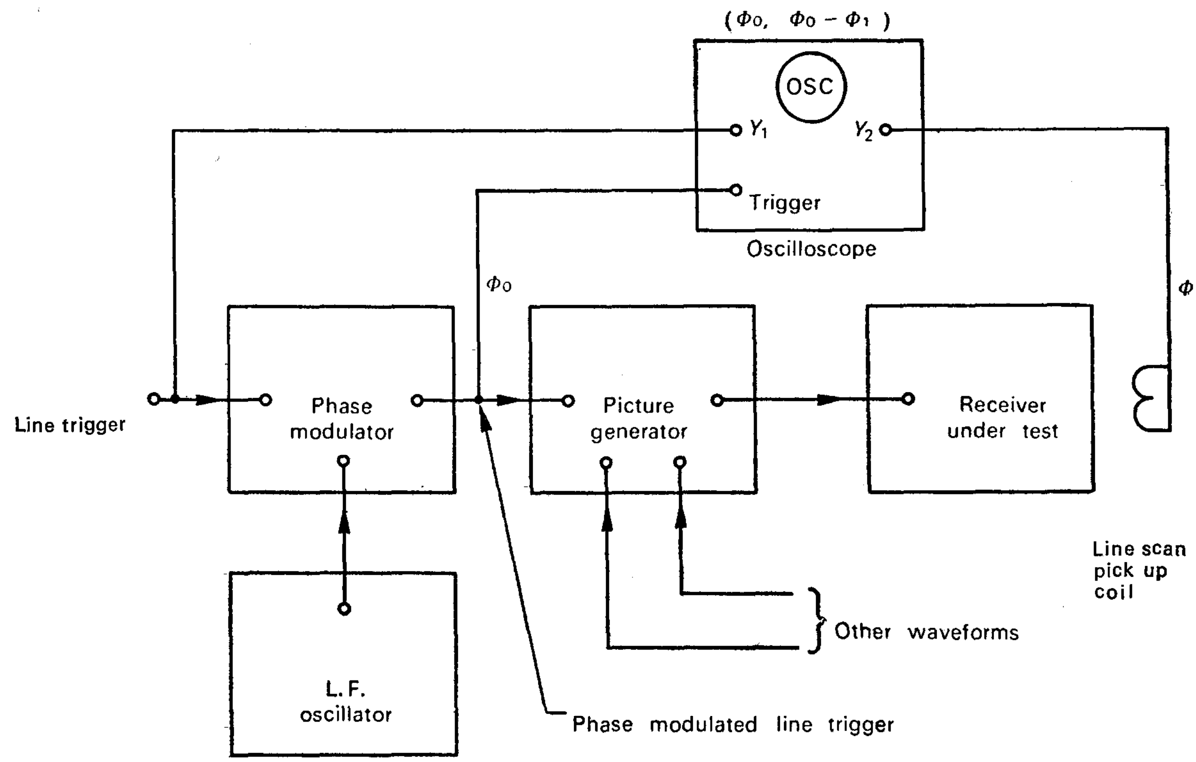
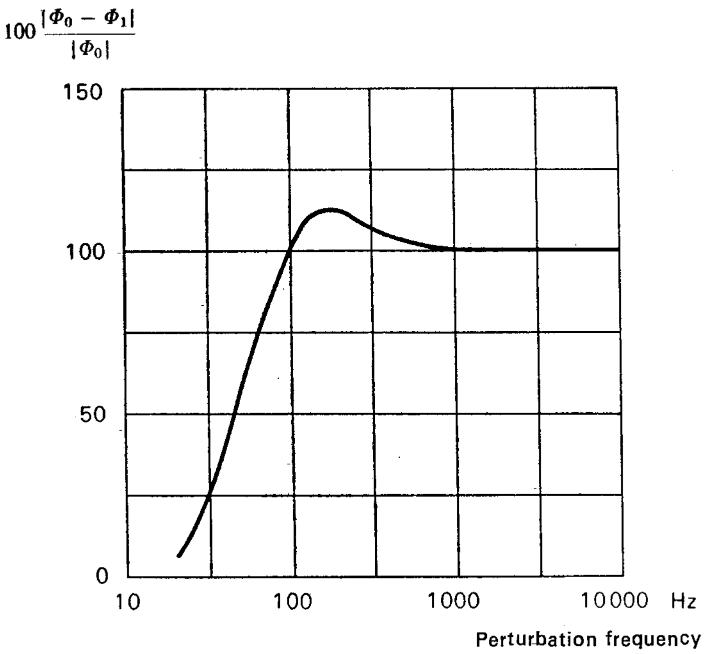


FIG. 1 LINE SCAN PHASE ERROR MEASUREMENT



ϕ_0=phase deviation of input synchronizing signal or equivalent fraction of line period.

ϕ_1=phase deviation of line scan oscillator output or equivalent fraction of line period.

FIG. 2 EXAMPLE OF LINE SCAN PHASE ERROR

4. LINE SCAN SYNCHRONIZING RANGE

4.1 Method of Measurement — The hold-in range of line scan generator is measured by setting the receiver for optimum performance using a signal of nominal line scan frequency. The receiver line scan oscillator frequency is then slowly varied in the high-frequency direction until synchronization is lost. The input signal is removed and the free-scanning frequency of the line scan generator is measured. This procedure is then repeated in the low-frequency direction and the two frequencies noted at which unlocking occurs. Since the line scan generator frequency may be influenced by noise present when the input signal is removed, it is recommended that the picture carrier input is retained and the modulation removed. The carrier level in the absence of modulation must be carefully controlled since overloading may take place when the synchronizing signal is not present.

The pull-in range is measured by adjusting the receiver line scan generator to a free-running frequency in the high-frequency direction outside the range at which locking occurs. The oscillator is then slowly moved towards the nominal frequency and frequency noted at which locking occurs. This procedure is then repeated starting from the low-frequency direction.

It may be convenient in some cases to carry out these measurements by varying the frequency of the master oscillator in the waveform generator.

Since receivers employing either direct lock rather than a flywheel or dual mode flywheel automatic phase control circuits may be capable of locking over a very wide range of frequencies care shall be taken with these measurements not to introduce so great a frequency error that damage to the scanning circuits might result.

The results may be conveniently expressed by marking the frequencies of interest on a frequency scale (*see* Notes 1, 2, 3, 4 and 5 under **13.1**).

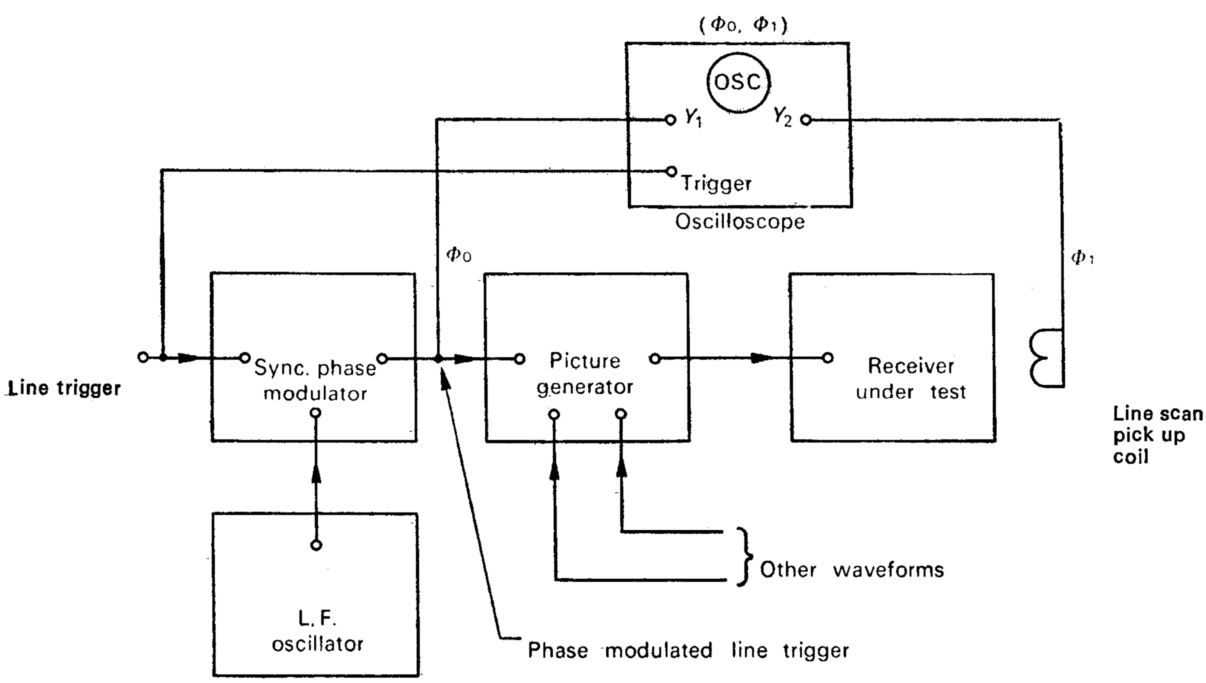
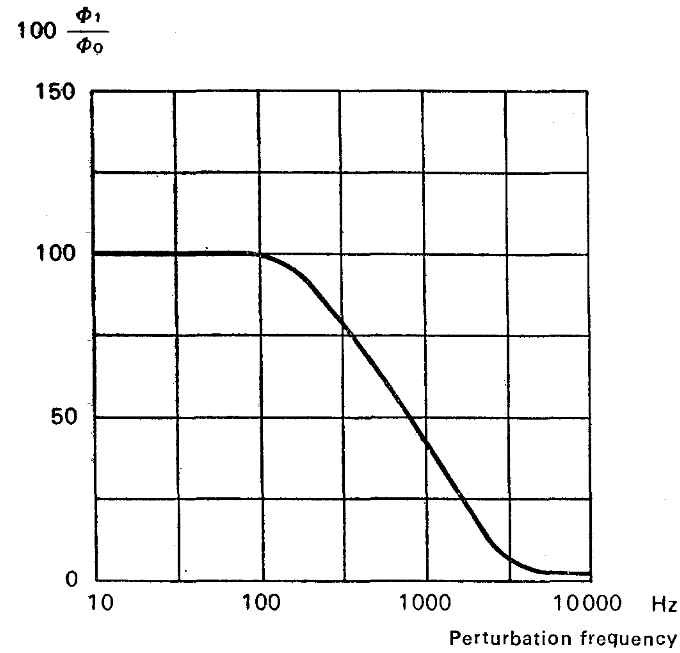


FIG. 3 LINE SCAN PHASE CHARACTERISTIC MEASUREMENT



ϕ_0=phase devitaion of input synchronizing signal or equivalent fraction of line period.

ϕ_1=phase deviation of line scan oscillator output or equivalent fraction of line period.

FIG. 4 EXAMPLE OF LINE SCAN PHASE CHARACTERISTIC

5. PULLING ON WHITES

5.1 Method of Measurement — A test pattern, having the appropriate black and white and black and coloured areas of high saturation and luminance (that is yellow) near the edges of the picture, is applied to the receivers and the horizontal displacement *d* of those parts of a vertical bar in the picture that are collinear with the picture content near the edges, this displacement is expressed as a percentage of the picture width (*see* Fig. 5A, Notes 1, 2, 3 and 4 under **13.1**).

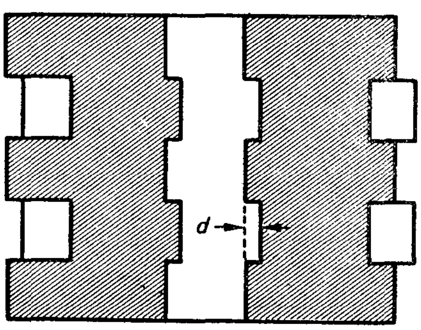


FIG. 5A PULLING ON WHITES

6. PULLING ON VERTICAL SYNCHRONIZING PULSES

6.1 Method of Measurement — This is measured as the horizontal displacement d_1 at the top of a vertical bar expressed as a percentage of the picture width *w* and the extent *v* of this effect expressed as a percentage of the picture height *h*. If the displacement exhibits one or more undulations, their positions in the vertical axis and their extent should be noted (*see* Fig. 5B).

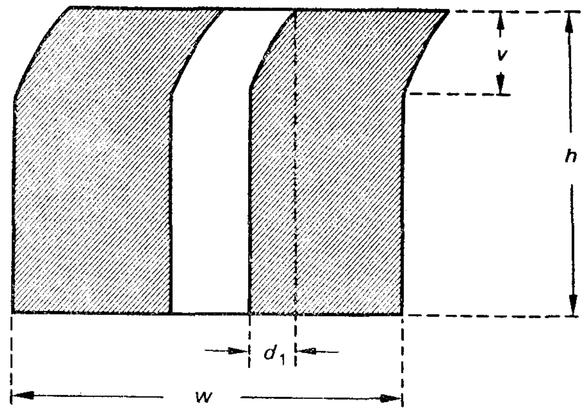


FIG. 5B PULLING ON VERTICAL SYNCHRONIZING PULSES

7. RAGGING

7.1 Method of Measurement — This is measured by displaying a test pattern signal containing vertical lines, random displacements of groups of scanning lines in the picture shall, where possible, be expressed as the average displacement as a percentage of picture width, together with the distribution in the vertical scan direction (*see* Notes 1, 2, 3, 4 and 5 under **13.1**).

8. WEAVE AND RIPPLE

8.1 Method of Measurement — Coherent horizontal displacements of a vertical bar shall be expressed as a percentage of picture width and the frequency or frequeacies estimated (*see* Notes 1, 2, 3, 4 and 5 under **13.1**).

9. HORIZONTAL SCAN PHASING

9.1 Method of Measurement — The accuracy of phasing of the scan relative to the line synchronizing pulses is assessed by expressing the portions w_1 of the picture at the left or right-hand edges that are missing or folded as a percentage of the picture width *w*. The effect of the horizontal frequency or horizontal hold control shall be included in the results. If the receiver is fitted with a horizontal phase control, this shall be adjusted to the optimum position (*see* Fig. 5C) (*see* Notes 1, 2, 3 and 4 under **13.1**).

10. QUALITY OF INTERLACE

10.1 Method of Measurement — The distances between a given scanning line of one identical field and the two adjacent lines belonging to the other interlaced field of the pair each expressed as a percentage of the distance between two consecutive lines of a single field, shall be measured at several points on the screen (*see* Fig. 6). Particular note is to be taken of the effect of the field or vertical hold control and the

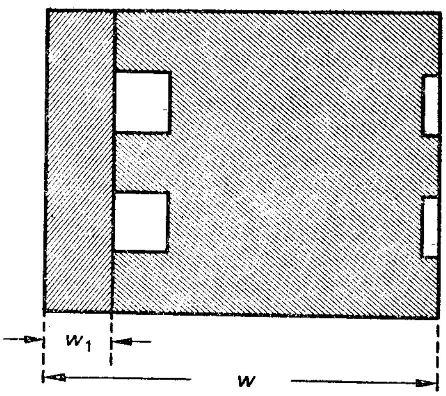


FIG. 5C HORIZONTAL SCAN PHASING

effect of small variations in the picture height and vertical linearity controls. If the receiver is fitted with an interlace control, this is adjusted for optimum performance (*see* Notes 1, 2, 3, 4, 5 and 6 under **13.1**).

11. JUMPING

11.1 Method of Measurement — Vertical movement of the picture is expressed as a percentage of the picture height, note being taken whether the disturbances are random or coherent (*see* Notes 1, 2, 3, 4, 5 and 6 under **13.1**).

12. SCAN GENERATOR FREQUENCY VARIATION WITH TIME

12.1 Method of Measurement — A television signal of −50 dB (mW) modulated with a test pattern is applied to the receiver input terminals and the receiver adjusted for optimum results. All modulation, including the synchronizing signals, is removed from the picture carrier which remains applied at a suitable level to suppress background noise effects that might otherwise influence the results.

Line and field scan frequency are set to their nominal value and a series of measurements made at suitable intervals until frequency stability has been achieved, with the receiver operating under conditions of constant supply voltage, ambient temperature and relative humidity. If applicable, the measurements shall be repeated at the lowest and highest values of ambient temperature to be encountered in practice.

NOTE — It may not be possible to carry out this test in some receiver designs since in such cases damage may occur to the scan generators, or misoperation of automatic gain control circuits may occur in the absence of synchronizing signals.

12.2 Presentation of Results — The variation in frequency is plotted as a function of time in a curve having as abscissa the time in minutes on a logarithmic scale and as ordinate the frequency change in hertz.

13. EFFECTS OF SCANNING CIRCUITS UPON COLOUR SIGNAL DECODING

13.1 Method of Measurement — A test pattern signal is applied to the receiver and the hold or scan frequency controls adjusted over the range giving satisfactory scan synchronization. Any effect upon colour decoding is noted.

NOTE 1 — This measurement may be carried out over a range of power supply voltages as described in 5 of IS : 4545 (Part 1)-1983*.

NOTE 2 — This measurement shall be carried out at an input signal level of —50 dB (mW) and at other levels as appropriate depending upon the behaviour of the receiver.

NOTE 3 — This measurement shall be repeated using a range of range adjustments of user controls.

NOTE 4 — This measurement may be carried out using picture content having low, medium and high average values.

NOTE 5 — This measurement may also be carried out with impulsive interference present on the input signal.

NOTE 6 — This measurement may be carried out for various phase relationships between supply mains wave-form and field synchronizing pulse.

*Methods of measurement on receivers for television broadcast transmissions: Part 1 General considerations (*first revision*).

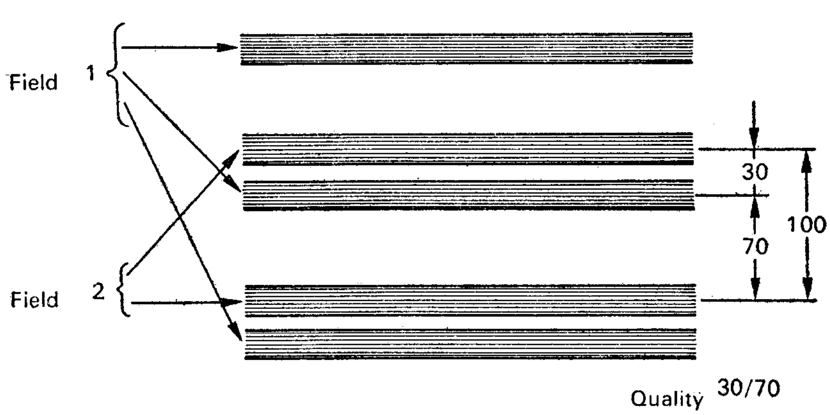


FIG. 6 QUALITY OF INTERLACE

14. FOLD OVER

14.1 Method of Measurement — The width of the part of the picture which is missing or folded should be assessed as a percentage of the width of the picture. The foldover effect may also be due to the non-linearity of the timebase circuits.

15. HUM-BAR

15.1 Method of Measurement — When a television picture of standard test card is on display, a horizontal black bar appears locked or moving up or down the screen at a slow rate (equal to difference between field frequency and the main frequency). This is due to the mains ripple adding to the video signal. This can be judged subjectively or measured by monitoring the video signal or by luminance measurements.

The receiver input terminals are fed with a $-50\ dB$ standard test chart signal, and the picture displayed on its screen. The video signal at the cathode of the picture is also recorded.

Measurement on seriousness of hum-bar can be made by recording the luminance at the screen and in the hum-bar region of the screen when the receiver is fed with a picture signal corresponding to a white field.

16. SYNCHRONIZING STABILITY

16.1 Frequency Drift of Time-Base Circuits in the Absence of Synchronization — During the heating-up period of the receiver the variation of the constants occurring in valves and other components will change the circuit constants of the time-base generators.

16.1.1 *Definition* — The variation of the free-running frequency of a time-base circuit during the heating-up period is called the frequency drift of that time-base circuit.

16.1.2 *Method of Measurement* — The receiver shall be adjusted for normal operation and standard video output voltage on a standard television signal. Thereafter the receiver shall be switched off for a sufficiently long period to cool off completely.

The signal shall be removed, the receiver switched on and the free-running frequency of the time-base circuit shall be measured with the aid of an oscilloscope and a generator.

The time at which the raster appears shall be noted, the corresponding frequency of the time-base circuit shall be measured and measurements continued until the frequency has become stable.

16.1.3 *Graphic Representation* — The frequency drift shall be plotted as a function of time in a curve having the time in minutes as abscissa and the frequency drift in Hz, as ordinate.

16.2 Frequency Shift of Time-Base Circuits — A variation in the supply voltage sometimes results in a shift of the free-running frequencies of the time-base circuits. This form of frequency shift follows the variations in the supply voltage rather quickly, but an allowance should be made in order to let the cathode temperature of the valves become stable again.

16.2.1 *Definition* — The variation of the free-running frequency of a time-base circuit as a function of the supply voltage is called the frequency shift of that time-base circuit.

16.2.2 *Method of Measurement* — The receiver shall be adjusted for normal operation and standard video output voltage on a standard television signal. The signal shall then be removed and the measurement started when the temperature frequency drift of the time-base circuits has reached a sufficiently steady state. The free-running frequency of the time-base circuit shall be measured with the aid of an oscilloscope and a generator or an electronic counter. The supply voltage shall first be lowered and then raised by 10 percent, and after about half a minute, in each case, the free-running frequency of the time-base circuit shall again be measured.

INDIAN STANDARDS INSTITUTION

Headquarters:
Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002
Telephones : 331 01 31, 331 13 75 Telegrams: Manaksanstha
(Common to all offices)

Regional Offices:	*Telephone*
*Western : Manakalaya, E9 MIDC, Marol, Andheri (East), BOMBAY 400093	6 32 92 95
†Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola, CALCUTTA 700054	36 24 99
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	2 18 43 3 16 41
Southern : C.I.T. Campus, MADRAS 600113	41 24 42 41 25 19 41 29 16
Branch Offices :	
'Pushpak', Nurmohamed Shaikh Marg, Khanpur, AHMADABAD 380001	2 63 48 2 63 49
'F' Block, Unity Building, Narasimharaja Square, BANGALORE 560002	22 48 05
Gangotri Complex, 5th Floor, Bhadbhada Road, T. T. Nagar, BHOPAL 462003	6 67 16
Plot No. 82/83, Lewis Road, BHUBANESHWAR 751002	5 36 27
53/5 Ward No. 29, R.G. Barua Road, 5th Byelane, GUWAHATI 781003	—
5-8-56C L.N. Gupta Marg (Nampally Station Road), HYDERABAD 500001	22 10 83
R14 Yudhister Marg, C Scheme, JAIPUR 302005	6 34 71 6 98 32
117/418B Sarvodaya Nagar, KANPUR 208005	21 68 76 21 82 92
Patliputra Industrial Estate, PATNA 800013	6 23 05
Hantex Building (2nd Floor), Railway Station Road, TRIVANDRUM 695001	52 27
Inspection Office (With Sale Point):	
Institution of Engineers (India) Building, 1332 Shivaji Nagar, PUNE 411005	5 24 35

*Sales Office in Bombay is at Novelty Chambers, Grant Road, Bombay 400007 89 65 28
†Sales Office in Calcutta is at 5 Chowringhee Approach, P. O. Princep Street, Calcutta 700072 27 68 00

Printed at Swatantra Bharat Press, Delhi, India